

Python ProgrammingInstructions:

- 1) All questions are compulsory.
- 2) Mixing of sub questions is not allowed.
- 3) Write in clear, legible, writing.

Subject Code: SIT101

Q1) Attempt any three:

(15)

- A) Explain the syntactic errors with examples.
- B) Explain formal and natural languages.
- C) Explain what are keywords and give a list of 20 keywords in python.
- D) Write a program that prompts the user to enter three integers and displays them in increasing order.
- E) Write a program that reads three edges for a triangle and computes the perimeter if the input is valid. Otherwise, display that the input is invalid. The input is valid if the sum of every pair of two edges is greater than the remaining edge.
- F) Write a program that prompts the user to enter a point (x, y) and checks whether the point is within the circle centered at (0, 0) with radius 'r'.

Q2) Attempt any three:

(15)

- A) Explain various conversion functions with examples.
- B) Explain five string functions with examples.
- C) Explain boolean, composite functions with examples.
- D) A positive integer is called a perfect number if it is equal to the sum of all of its positive divisors, excluding itself. Write a program to find these four numbers.
- E) Write a program to display all numbers less than 100000 which are divisible by both 15 and 18.
- F) A pentagonal number is defined as $n(3n - 1)/2$ for $n = 1, 2, \dots$ and so on. So, the first few numbers are 1, 5, 12, 22, Write a function "getPentagonalNumber(n)" that returns a pentagonal number. Write a test program that uses this function to display the first 100 pentagonal numbers.

Q3) Attempt any three:

(15)

- A) Explain a dictionary in python and functions associated with it with examples.
- B) Explain the difference between list and tuples.
- C) Explain five built-in exceptions in python.
- D) Write a program that reads an unspecified number of scores and determines how many scores are above or equal to the average and how many scores are below the average.

- E) Write a program in python to generate a list of 500000 random integers between 0-9. Store the frequency of each number and display the same.
- F) Write a function 'merge(x,y)' which merges two sorted lists 'x' and 'y' to create a final sorted list.

Q4) Attempt any three: (15)

- A) Explain usage of meta characters '\$' and '^' in a regular expression in python.
- B) Explain five methods from the math module in python.
- C) What do you mean by synchronization of threads and how it is achieved in python.
- D) Create a class to encapsulate a vector (having i, j, k components). Define the appropriate 'constructor'. Define functions to return the sum and cross product of the calling vector object and another vector object passed as an argument.
- E) Create a class 'Stock' which stores the name of the company, face value of the stock, its current market price, and the quantity. Create stocks of some companies and display their details.
- F) Implement a 'VotingMachine' class that can be used for a simple election. Have methods to clear the machine state, to vote for party 'A', to vote for party 'B', and to get the tallies for both parties.

Q5) Attempt any three: (15)

- A) Explain the three layout managers in python.
- B) Explain the Radiobutton widget with an example.
- C) Explain the Label widget with an example.
- D) Write a python code to create a GUI application to convert 'kilograms' to tonnes.
- E) Write a python code to display error, info message box.
- F) Write a python code to create a GUI application for a currency convertor.

IT 11/10

Max Time: 2½ hrs

SYBSc-IT Semester III

Max Marks: 75

Subject: Computer Network

Instructions:

1. All questions are compulsory.
2. Mixing of sub questions is not allowed.
3. Write in clear, legible, writing.
4. Draw diagrams wherever necessary

Subject Code: SIT102

Q1) Attempt any four of the following. (20)

- A. What is computer network? Explain types of computer network.
- B. Write note on Modem and Router.
- C. Draw and Explain TCP/IP Model.
- D. Write comparison between switch and hub.
- E. Write note on periodic analog signal.
- F. Discuss design issues followed at data link layer

Q2) Attempt any four of the following. (20)

- A. Explain different types of errors that occur while transmission of data.
- B. Explain Checksum error correction method with example.
- C. Write note on Satellite network.
- D. Explain the Architecture of 802.11.
- E. What is handoff in cellular network? Explain its types.
- F. Explain different types of errors handled by ICMP.

Q3) Attempt any four of the following. (20)

- A. Write note on router and switches.
- B. Explain IPV6 packet format.
- C. Write about the timers used by ARP.
- D. Explain OSPF protocol.
- E. Explain working of sliding window protocol.
- F. Write note on UDP protocol.

Q4) Attempt any four of the following. (15)

- A. Explain stop and wait protocol.
- B. Write characteristics of wireless LAN.
- C. Write role of transport and network layer in OSI model.
- D. Explain the terms Amplitude, frequency and phase used in signals.
- E. Write about star and bus topologies used in networking.
- F. Explain different transition strategies used to convert from IPV4 to IPV6.

instructions:

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Subject Code: SIT103

Q I Attempt any three: -**(15)**

- A) What is meant by data structures? Discuss the various types of data structures.
- B) What are the benefits and drawbacks of using arrays?
- C) Define algorithm complexity and explain the different types.
- D) How do you traverse an array? Explain how elements can be inserted and removed from an array.
- E) What are the different sorting algorithms that can be used with arrays?
- F) How are insertion and deletion operations handled in a doubly linked list?

Q II Attempt any three: -**(15)**

- A) Explain One-Way Linked List with its operation and implementation.
- B) What are the applications and implementation of Circular Linked List? Give its advantages..
- C) How to insert new node in existing linked list? Give example.
- D) What are circular linked lists, and where are they used?
- E) Discuss the process of reversing a linked list.
- F) Explain the concept of a two-way linked list and its applications.

Q III Attempt any three: -**(15)**

- A) What is a stack, and how does it follow the Last In, First Out (LIFO) principle?
- B) What are the primary operations (push, pop, peek, and isEmpty) performed on a stack?
- C) How can a stack be implemented using an array, and what are the benefits and limitations of this approach?
- D) What are some real-world applications of queues?
- E) What is a circular queue, and how is it different from a regular queue?
- F) What is a priority queue, and in what scenarios are priority queues particularly useful?

Q IV Attempt any three: -**(15)**

- A) What is Bubble Sort, and how does it work?
- B) Explain the working of Selection Sort. What are its time complexities?
- C) Describe the process of Insertion Sort. How does it differ from Selection Sort?
- D) What is a Binary Search Tree (BST), and how does it differ from a binary tree?
- E) Explain the concept of a heap and its memory representation. What are the primary operations that can be performed on a heap?
- F) What is an AVL Tree, and how does it maintain balance? Describe the operations performed on an AVL tree.

Q V Attempt any three: -**(15)**

- A) What is hashing, and why is it significant in data structures?
- B) Outline the various types of hash functions and their key features.
- C) How are collisions handled in hashing? Provide a detailed explanation of linear probing.
- D) Discuss the Breadth-First Search (BFS) and Depth-First Search (DFS) algorithms comprehensively.
- E) What are the practical applications of graphs in computer science and other real-life situations?
- F) Describe the concept of finding the shortest path in graphs, and explain Dijkstra's algorithm.

Max Time: 2½ hrs

SYIT Semester III

Max Marks: 75

Applied MathematicsInstructions:

- 1) All questions are **compulsory**.
- 2) Mixing of sub questions is not allowed.
- 3) Write in clear, legible, writing.

Q1) Attempt any three:

(15)

A) Verify Cayle – Hamilton theorem for

$$A = \begin{bmatrix} 3 & 2 \\ 4 & 1 \end{bmatrix} \text{ and hence find } A^6 - 2A^5 + 3A^4 - 6A^3 + 4A^2 - 3A + 2I$$

B) Solve the following set of equations using elementary transformations

$$x + 3y + 3z = 5, \quad x + 4y + 3z = 6, \quad x + 3y + 4z = 2$$

C) Find modulus and argument of

$$\frac{(2 - 3i)(5 + 3i)}{3 - 2i}$$

D) Simplify

$$\frac{(\cos 3\theta + i \sin 3\theta)^5 (\cos 2\theta - i \sin 2\theta)^7}{(\cos 2\theta + i \sin 2\theta)^{12} (\cos 5\theta - i \sin 5\theta)^5}$$

E) find $\log(1 + i)^i$

F) Write the definition of Matrix & types of Matrices.

Q2) Attempt any three:

(15)

A) Solve the following by Method for Equation Homogeneous in x and y

$$(x^2 + y^2)dx - 2xy dy = 0$$

B) Solve the following by Method for Extact Differential Equations

$$(x - 4xy - 2y^2) dx + (y^2 - 4xy - 2x^2)dy = 0$$

C) Solve the Linear Equation

$$\frac{dy}{dx} + \frac{2x}{x^2 + 1} y = \frac{4x^2}{x^2 + 1}$$

D) Solve the following by Solvable for y

$$xp^2 - 2yp + ax = 0$$

E) Solve the following DE $f(D)y = 0$

$$\frac{d^3y}{dx^3} - 2\frac{d^2y}{dx^2} - 5\frac{dy}{dx} + 6y = 0$$

F) Solve the following by Method of Separation of Variable

$$\frac{dy}{dx} = e^{x-y} + x^2e^{-y}$$

Q3) Attempt any three:

(15)

A) prove the First Shifting theorem of laplace transform :
 if f be a function with the laplace transform such that $L[f(t)] = F(s)$ then
 $L[e^{at} \cdot f(t)] = F(s - a)$, where a is any constant.

B) Find the Laplace transform of following functions
 (a) $f(t) = 6t^3 - 3\cos(2t) + 7e^{-2t}$ (b) $L[t^3 + 5t - 2]$

C) Find $L[f(t)]$, where $f(t)$ is defined as

$$f(t) = 0, \text{ for } 0 \leq t < 2$$

$$= e^{2t}, t \geq 2$$

D) Find the Inverse Laplace Transformation

(a)
$$F(s) = \frac{1}{s-2} - \frac{3s}{s^2+16} + \frac{5}{s^2+9}$$

(b)
$$F(s) = \frac{1}{s^2+4}$$

E) Find laplace inverse tranform by using Second Shifting Property

$$\frac{e^{-5s}}{(s-2)^4}$$

F) Evaluate the following
 (a) $L[\sin(2t + 3)]$ hint: use $\sin(A + B)$
 (b) $L[(\sin t - \cos t)^2]$

Q4) Attempt any three:

(15)

A) Evaluate the following $\int_0^{\sqrt{\pi/2}} \int_0^{x^2} x \cos y \, dy \, dx$

B) Find $\int \int_R 1 \, dA$ where the region R is bounded by the curves $y^2 = 2x$ and $y = x$.

C) Find $\int \int_R e^{-(x^2+y^2)} dx \, dy$ where R is the region between two circles $x^2 + y^2 = 1$ and $x^2 + y^2 = 4$.

D) Evaluate the following $\int_0^1 \int_0^{1-x} \int_0^{1-x-y} dz \, dy \, dx$

E) Evaluate $\iiint_R dV$, $R: 0 \leq x \leq 1, x^2 \leq y \leq x, x^2 y \leq z \leq x\sqrt{y}$.

F) Evaluate $\iiint_R \frac{y+z}{x} dV$, $R: 1 \leq x \leq 4, 1 \leq y \leq x, 1 \leq z \leq y$.

Q5) Attempt any three:

(15)

A) prove that : $\beta(m, n) = \beta(n, m)$

B) proof that, $\overline{n+1} = n\overline{n}$

C) Evaluate the following $\int_0^\infty e^{-x^3} dx$

D) Evaluate the following by using DUIS method

$$\int_0^1 \left(\frac{1-x^\alpha}{\log x} \right) dx, \alpha \geq 0$$

E) . Proof the given error function

i) $\text{erf}(0) = 0$ ii) $\text{erf}(\infty) = 1$

F) Integration of error function :

$$\int_0^t \text{erf}(ax) dx = t \cdot \text{erf}(at) + \frac{e^{-a^2 t^2}}{a\sqrt{\pi}} - \frac{1}{a\sqrt{\pi}}$$

Operating SystemsInstructions:

- 1) All questions are **compulsory**.
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- 3) Write in clear, legible, writing.

Subject Code: SIT105

Q1) Attempt any three:**(15)**

1. Write a short note on Simple Batch Systems
2. What are the responsibilities of OS relating to memory management?
3. Explain the concept of Virtual memory and its addressing with the help of a neat diagrams
4. Explain the different transitions between states that the process takes
5. When does a process switch take place?
6. What is a Process Control Block? What does it contain?

Q2) Attempt any three:**(15)**

1. What is a Thread? Differentiate between Process and Thread.
2. What are the different Thread states? Explain
3. Explain the concept of Race Condition through an example
4. Explain the concept of ensuring mutual exclusion by using **any one** Machine level instruction:
(i) Compare&Swap (ii) Exchange
5. Describe the Producer Consumer problem
6. Explain Message Passing between processes. Explain the following with respect to Message passing:-
 - a. synchronization
 - b. Addressing
 - c. Relationships between senders and receivers

Q3) Attempt any three:**(15)**

1. How can a deadlock be detected? Explain
2. Consider a system with five processes P_0 through P_4 and three resource types A , B , and C . Resource type A has ten instances, resource type B has five instances, and resource type C has seven instances. Give the sequence of process execution so that the system is in safe state using Bankers Algorithm. Suppose that, at time T_0 , the following snapshot of the system has been taken:

	<u>Allocation</u>	<u>Max</u>	<u>Available</u>
	A B C	A B C	A B C
P ₀	0 1 0	7 5 3	3 3 2
P ₁	2 0 0	3 2 2	
P ₂	3 0 2	9 0 2	
P ₃	2 1 1	2 2 2	
P ₄	0 0 2	4 3 3	

3. Explain the Dining Philosopher's problem and its solution using semaphores
4. What are the different Placement Algorithms in Dynamic partitioning? What are the advantages and disadvantages of Dynamic Partitioning? How do you overcome its disadvantage
5. Write a note on segmentation and segmentation hardware with the help of neat diagrams. What are the advantages and disadvantages of segmentation?
6. Explain the concept of virtual memory(using paging) with a neat diagram

Q4) Attempt any three:

(15)

1. What are the different types of schedulers? Explain each
2. What is the granularity at which tasks can be divided amongst multiple processors?
3. Write a note on some commonly used real time scheduling algorithms
4. What are the criteria for scheduling?
5. What are the different types of multiprocessor systems? Explain each
6. Explain the Shortest Job First scheduling algorithms. Consider the following processes along with their arrival time and CPU burst time in milliseconds. Considering SJF scheduling, calculate their wait time, average wait time, turnaround time and average turnaround time. Also draw the Gantt Chart

Process	Arrival Time	Burst Time
P1	0	8
P2	3	5
P3	4	10
P4	6	9
P5	11	7

Q5) Attempt any three:

(15)

1. Explain the following Disk Scheduling policies with the help of a neat diagram:- FCFS, SCAN, CSCAN, LOOK, CLOOK
2. What are the various operations that can be performed on a file?
3. Explain the following File Allocation Methods on a disk:- Contagious, Indexed
4. Explain the various techniques of free space management
5. Explain the different directory operations
6. What are the common file access rights that can be given to another user?
